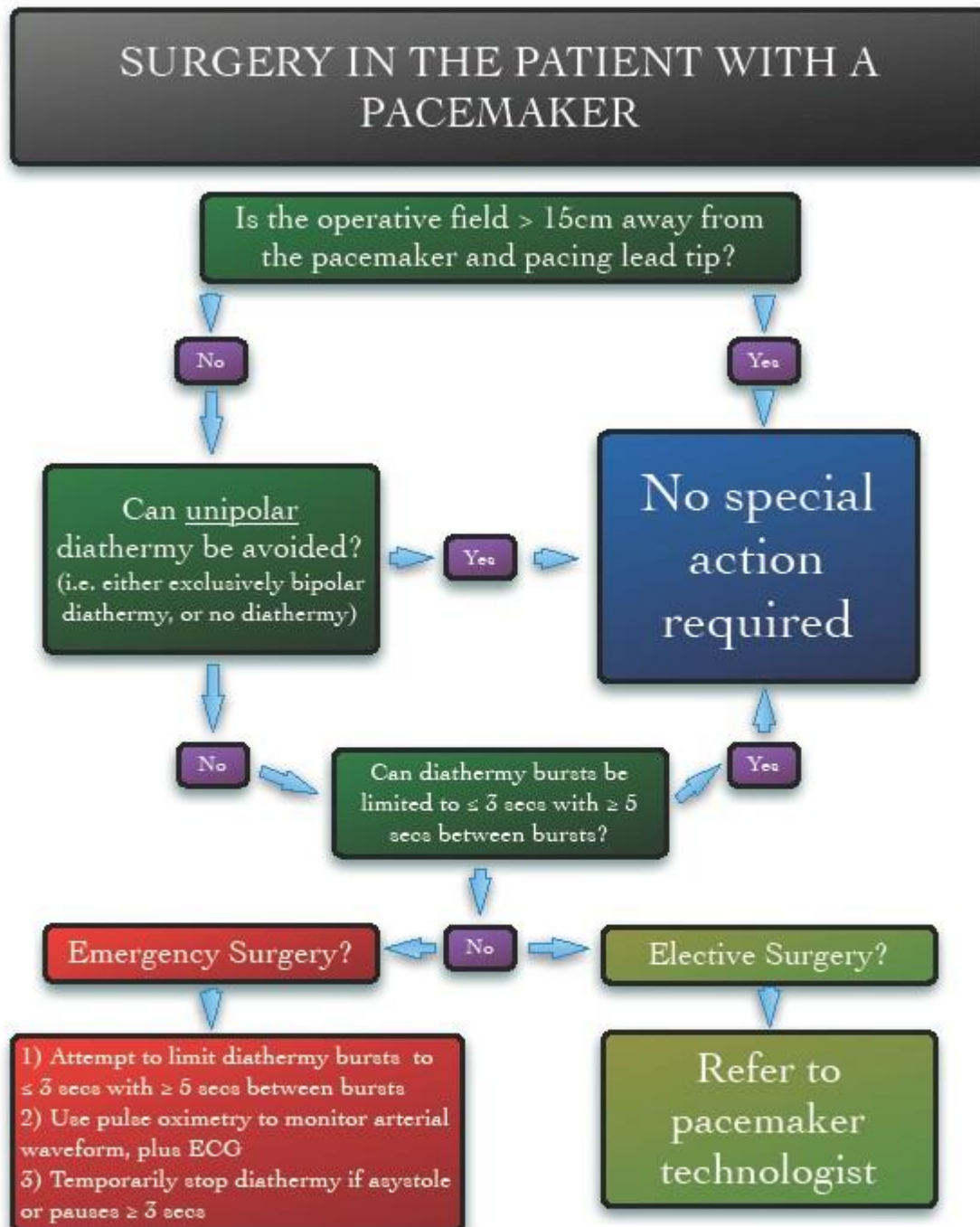


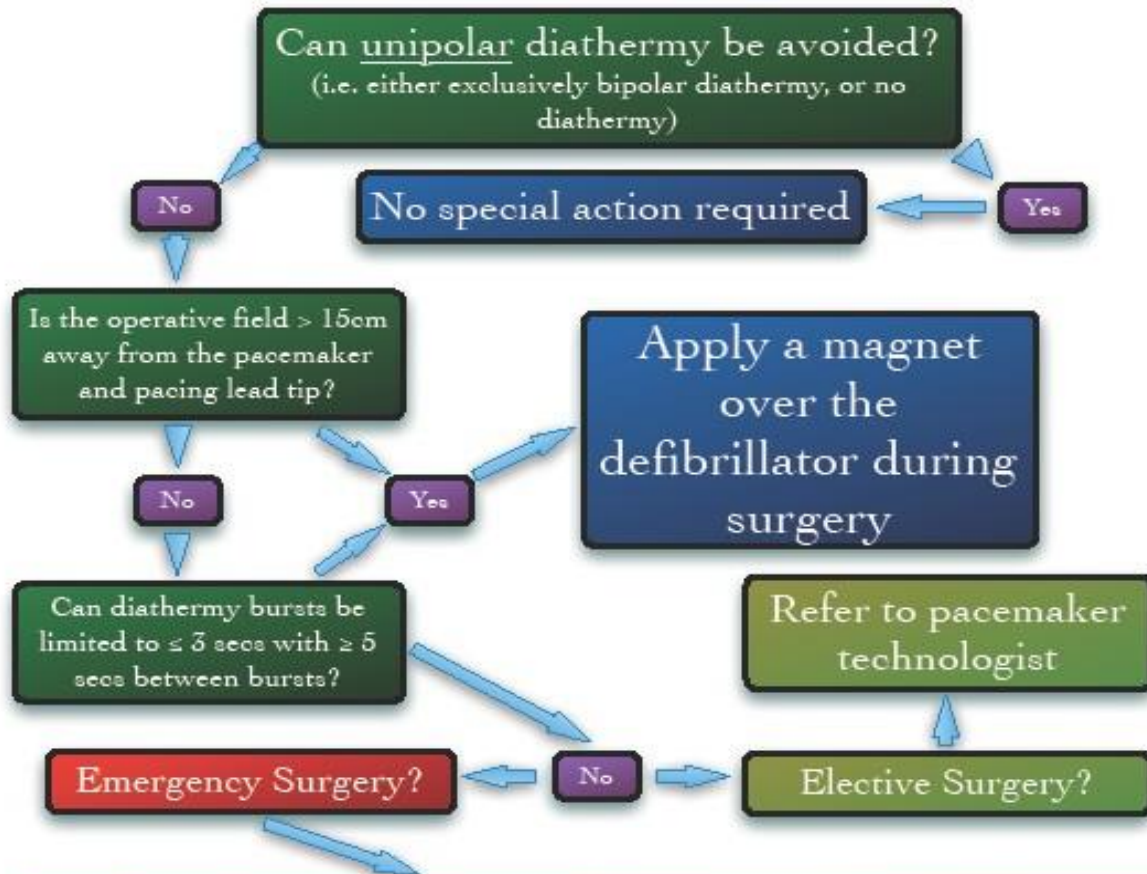
# Management of Permanent Pacemaker (PPM) and Internal Cardiac Defibrillators (ICD) in the Emergency and Elective Surgical Settings

- For optimal viewing of this document please use a colour printer
- See explanatory notes and FAQs relating to this algorithm.



\*There is no need to interrogate the pacemaker simply because diathermy was used during the case. If the device was programmed prior to surgery, reprogramming will be necessary post-op.  
\* The use of magnets is not recommended for pacemakers as the response is variable depending on manufacturer and model. (Not all pacemakers are placed in an asynchronous pacing mode in response to a magnet). The operation can be performed safely following the algorithm above.

# SURGERY IN THE PATIENT WITH AN INTERNAL CARDIAC DEFIBRILLATOR



- 1) Apply a Magnet directly over the ICD
- 2) Attempt to limit diathermy bursts to  $\leq 3$  secs with  $\geq 5$  secs between bursts
- 3) Use pulse oximetry to monitor arterial waveform, plus ECG
- 4) Temporarily stop diathermy if asystole or pauses  $\geq 3$  secs
- 5) If VT/VF observed, remove magnet from ICD and wait for ICD therapy (this may take 20secs)

\* The magnet must be removed at the end of surgery. The ICD will automatically re-enable usual therapies. No device interrogation is necessary simply because the magnet has been used. If the device was programmed prior to surgery, reprogramming will be necessary post-surgery.

\* The pacemaker technologist can be contacted via JHH on 49223142 or page #6484 during normal hours. For after-hours cases contact the pacing and EP team.

## GUIDELINE INTRODUCTION

The patient with a Permanent Pacemaker or Internal Cardiac Defibrillator who is undergoing planned surgery should be formally assessed via a surgical pre procedure clinic. This should include a recent pacemaker check report. This guideline will assist all clinicians in the management of this group of patients

The patient with a Permanent Pacemaker or Internal Cardiac Defibrillator who is undergoing emergency surgery presents unique challenges for all clinicians. This guideline will assist all clinicians in the management of this group of patients

Operating theatre staff may refer to the following flowcharts for use of diathermy during surgery.

## FREQUENTLY ASKED QUESTIONS

- **What is a pacing technologist and a company representative? What is the referral process to the pacing technologist?** A pacing technologist is a hospital employee who is trained in the interrogation and programming of PPM and ICD. A company representative is employed by a private company who distribute, and assist with the process of implementation of ICD and PPM. In the absence of a local pacing technologist it may be appropriate to contact the local cardiac service for further advice. The pacing technologist may potentially advise a number of approaches including:
  - *Do nothing*
  - *Use a magnet*
  - *Temporary reprogramming of the device prior to surgery: **Note:** This may require the patient to be transferred to a major Hospital*
- **Where is 15 cm taken from in the operative field?** This is 15 cm away from both the generator, and the tips of the pacing leads. In fact, avoiding the pacing lead tips is more important than the pacemaker generator. This is so because very few devices are programmed to a “unipolar” sensing mode (sensing between the pacing tip and the pacemaker generator), virtually all have bipolar sensing (between the 2 electrodes at the pacing lead tip). Surgery on the head should be fine, but all chest surgery will be affected and theoretically upper abdominal surgery as well.
- **Will there be interference with pulse oximeters?** There should not be any issue between pulse oximeters and all current devices. Similarly there should not be a problem with diathermy.
- **When should Defibrillator pads be used?** Defibrillator pads are only required if ICD therapies have been disabled by the pacing technologist prior to surgery. If applied Defibrillator pads should never be put within 10cm of the ICD site.
- **Where do we get magnets from and where should they be stored.** If you require magnets please contact a pacing technologist during business hours to arrange purchase. In terms of storage each anaesthetic unit should arrange storage of magnets as they wish.
- **What is the 3 and 5 second rule?** The 3 second and 5 second rule is a conservative position. The problem is of diathermy-induced temporary cessation of pacemaker function (due to the device interpreting the diathermy current as spontaneous cardiac activity, and thereby not delivering pacing). If the patient was completely pacing dependent, and if there was complete cessation of pacemaker function during this time, then the longest pause would be 3 seconds. The 5 seconds between bursts is to allow a small number of paced beats before the next potential pause. **Note: diathermy should never be delivered to a patient with an active ICD (i.e. therapies not programmed off of magnet not over ICD, not even for 3 seconds)**
- **What is unipolar diathermy and what is its impact on pacing?** Unipolar diathermy is the standard form. It is actually still “bipolar” but the other pole is far away, and large (this is the patch applied to the patient’s body, the so-called “indifferent electrode”). The effect is to concentrate the tissue heating close to the small electrode that the surgeon is using (tissue heating is proportional to the resistance to flow of the current; resistance is highest at the small electrode, and minimal at the large electrode.) The path of the current is large, travelling in the most electrically economical ways from the diathermy pen to the indifferent electrode. Thus placement of this indifferent electrode is very important. It should be placed in a position to minimize the chance of current flow past the ppm generator and pacing lead tips (the parts of the pacing lead which are exposed to the body). With bipolar diathermy, the diathermy pen has 2 tips, which are quite close (generally about 5mm), and current flows only between these 2 tips. Hence, unless diathermy were to take place directly over the device, there is no chance of extraneous current being picked up by it

- **The impact of magnets and pacemakers?** All devices are safe with magnets today. In the past, with older pacemakers, a magnet placed over the pacemaker would physically move a “reed-switch”, which would allow entry of external current into the pacemaker itself. Currently many devices have changed to an electrical switch, and all pacemakers and ICDs are fitted with a strong resistor (the zener diode) capable of preventing large voltage spike into the device. Consequently, the chance of device malfunction as a result of diathermy while a magnet is in place is realistically not an issue these days. To damage a device you would have to defibrillate close to the device while a magnet was in place. Note: not all pacemakers respond to a magnet by switching to an asynchronous pacing mode, so therefore the current recommendations do not suggest using magnets on pacemakers during surgery.
- **The patient has an ICD or PPM but you are not sure what it is?** A number of strategies maybe used to identify what the device is; the patient should carry with them a card given to them by the device company, this will have details of generator and leads. If this does not answer the question please discuss with the pacing technologist or contact one of the **Pacing and Electrophysiology Team**:
- **Where do we obtain magnets from, and how do we place them?** It is up to each individual Anaesthetic site to define where it is located. The magnet should be placed directly over the ICD for the procedure.
- **Post procedure monitoring and magnets?** As a routine the patient who has a magnet placed on their ICD during a procedure does not require a monitored bed after the procedure. To clarify the patient does not require special monitoring post procedure if a magnet has been used nor is device interrogation required.
- **When assessing patients do you need to get a recent pacemaker check report?** Yes for a planned procedure a comprehensive surgical workup plan should include obtaining a recent PPM check report.
- **Does the patient need special Antibiotic cover if they have an ICD/PPM?** No
- **Definition of Terms:-**
  - Unipolar diathermy is the emitance of the High Frequency Alternating Current (HFAC) from the diathermy via an active electrode through the patient's body tissues and returned back to the diathermy machine via a return electrode or patient return pad (Association for Perioperative Practice (AfPP) 2011)
  - Bipolar diathermy is the passage of the HFAC from the diathermy machine down one prong of a bipolar forcep through the tissue that has been placed between the forcep tips and returned to the diathermy machine via the second prong

## REFERENCES

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- Jacob,S.,Panaich,S., Maheshwari,R., Haddad,J., Padanilam,B.,John,S. (2011) Clinical applications of magnets on cardiac rhythm. *Europace* 13 1222-1230. Doi:10.1093/europace/eur137.

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